II. RESPONSE TO THE OFFICE ACTION

A. General Remarks

Claims 1-19 are pending in the application.

Claims 1-19 were rejected prior to this response.

Claims 1, 7, and 18 have been amended. For the convenience of the Examiner, all pending claims are presented in this paper. A copy of the amended claims in marked-up format accompanies this response as an Attachment. If there is any discrepancy between the claims presented in this paper and the amendments shown in marked-up format, Applicants request that the claims shown in this paper be considered controlling.

Claim 1 has been amended herein to recite "a circuit for energizing the phase winding over a plurality of energization cycles with a unidirectional current of a single polarity." The amendment to claim 1 is at least supported by Figures 1B, 5B, and 12A and by the specification on page 3, ll. 9-17; page 16, ll. 4-27; page 30, ll. 3-22; and page 45, ll. 1-9.

Claims 7 and 18 have been amended herein to improve the reading of the claims and correct typographical informalities. The amendments to claims 7 and 18 have not been for any reason related to patentablity, rejection, or objection presented by the Examiner.

B. Specific Comments

Applicants' specific comments are presented below in response to the Examiner's statements, which have been reprinted in 10 pt, bold and italicized font.

Drawings

The corrected or substitute drawings were received on June 12, 2002. These drawings are acceptable.

The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on June 12, 2002 have been approved. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance.

The Patent and Trademark Office no longer makes drawing changes. See 1017 O.G.4. It is applicant's responsibility to ensure that the drawings are corrected. Corrections must be made in accordance with the instructions below.

Applicant has the understanding that no further action is required with respect to the corrected drawings and substitute drawings showing the correction in clean form received by the Office on June 12, 2002.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:
A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country. more than one year prior to the date of application for patent in the United States.

1. Claims 1-4 are rejected under 35 U.S.C. 102(b) as being anticipated by Cho (U.S. Pat. 5,959,373).
Referring to claim 1, Cho discloses a linear electromagnetic machine comprising:
a movable member (30);
a stationary member (9) defining at least one stationary pole;
a phase winding positioned such that, when current is flowing in the phase
winding, the at least one stationary pole is energized; and
a circuit (figure 3) for energizing the phase winding over a plurality of energization cycles to produce a given force tending to cause linear movement of the movable member (30) with respect to the stationary member (9), the energizing of the phase winding also producing a normal force (thrust) tending to cause movement of the movable (30) and stationary (9) members in a direction normal to the desired linear movement; wherein
the normal force profile (thrust) experienced by the at least one stationary pole over a first energization cycle is different from the normal force profile (thrust) experienced by the at least one stationary pole over a subsequent energization cycle (figures 12).
Referring to claim 2, Cho discloses that the movable member (30) defines a plurality of movable poles (figure 8A) that pass over the at least one stationary pole as the movable member (30) moves in the desired direction and wherein at least one of the movable poles is different in construction from other of the movable poles.
Referring to claim 3, Cho discloses that the movable poles each define a pole width (p_j) and wherein at least one of the movable poles has a width (p_j) that is greater than the width (p_i of other of the movable poles (figure 8A).
Referring to claim 4, Cho discloses that the movable poles all have substantially the same width (p_j), wherein each movable pole defines an air gap with respect to the stationary pole as it passes over the stationary pole, and wherein the air gap defined by at least one of the movable poles is different from the air gap defined by other of the movable poles (see figure 8C).

Applicants' respectfully traverse the conclusion that Cho anticipates claim 1-4 insofar as independent claim 1 contains limitations not disclosed or suggested in Cho.

For example and without limitation, claim 1 requires "a circuit for energizing the phase winding over a plurality of energization cycles with a unidirectional current of a single polarity."

Contrary to claim 1, the circuit of Cho discloses converting direct current in a converter to "a three-phase alternating current having a predetermined frequency, and releasing the converted alternating current to respective wires u, v, w of the core laminations 12 in the linear motor 100" (col. 2, ll. 4-10). Consequently, Cho specifically discloses and suggests supplying a three-phase sinusoidal energization to the core laminations (12) in the linear motor (100). Thus, Cho does not disclose or suggest a circuit for energizing the phase winding over first and subsequent energization cycles with a unidirectional current of a single polarity. Accordingly, Applicant submits that claim 1 is not anticipated by Cho.

For at least the reasons presented above, Applicant respectfully requests that the above rejection of independent claim 1 under 35 U.S.C. §102(b) be reconsidered and withdrawn and that the Examiner indicate the allowance of the claim in the next paper from the Office. The claims 2-4 depending from claim 1 are believed to be allowable for at least the same reasons discussed above.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> ***(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.***

2. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cho in view of Delson et al. (U. S. Pat. 6,002,184).

Cho substantially teaches the claimed invention except that it does not show that the circuit for energizing the phase winding provides an energization current to the phase winding over a first energization cycle that is different from the energization current provided to the phase winding over a second energization.

Delson et al. disclose that the circuit for energizing the phase winding provides an energization current to the phase winding over a first energization cycle that is different from the energization current provided to the phase winding over a second energization (column 36, lines 41-57). The invention of Delson et al. has the purpose of controlling the overall stiffness of the embodiment.

It would have been obvious at the time the invention was made to modify the motor of Cho and provide it with the energization current pattern disclosed by Delson et al. for the purpose of controlling the overall stiffness of the embodiment.

As noted above, Cho does not disclose or suggest all of the limitations of claim 1 from which claim 5 depends. Delson et al. fails to provide the limitations missing from Cho and further fails to show that the circuit for energizing the phase winding provides an energization current to the phase winding over a first energization cycle that is different from the energization current provided to the phase winding over a subsequent energization as required by claim 5.

Delson et al. discloses an actuator using opposing repulsive magnetic forces. In column 36, lines 41-57, Delson et al. does not disclose using energization cycles and instead discloses selecting current levels for multiple actuators to merely achieve a desired mechanical stiffness between the actuators. In further contrast to the claimed invention, Delson et al. merely discloses adjusting the current to the actuators to specify arbitrary set positions. See col. 32, ll. 49-67. For example, Delson et al. discloses a circuit in Figure 20 that includes a signal generator (500) and an amplifier (525), which adjust current to an electromagnetic coil (514). See col. 20, ll. 44-49. Accordingly, Applicant submits that claim 5 is not rendered obvious over Cho in view of Delson et al.

Even if it were appropriate to combine these reference, which Applicant does not concede, the combination of Cho in view of Delson et al. cannot render Applicant's claim 5 obvious, as these references, either alone or in combination, do not disclose or suggest all of Applicant's claim limitations.

For at least the reasons presented above, Applicant respectfully requests that the above rejection of claim 5 under 35 U.S.C. §103(a) be reconsidered and withdrawn and that the Examiner indicate the allowance of the claim in the next paper from the Office.

3. Claims 6-8, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzuka (U.S. Pat. 4,217,508) in view of Keljik (Electric Motors and Motor Controls; Jeff Keljik; Delmar Publishers 1995; pages 9-12).

Uzuka discloses an electromagnetic machine comprising:

a rotor (101) defining a plurality of rotor poles (108A,108b,107a,107G in figure 18A), each rotor pole (108A,108B,107A,107G) having a pole face defining an angular width, wherein the angular width of the rotor pole with the widest width (18A) is:

(a) substantially equal to the angular width of the rotor pole with the narrowest width (108b), and

(b) less than 1.5 times the angular width of the rotor pole with the narrowest width (108b);

a stator (103) defining at least two stator poles (created by windings 110A,110B) that are radially opposed to one another;

a phase winding (110A, 110B) positioned such that, when current is flowing in the phase winding (110A, 110B), the at least two stator poles (induced by windings 110A,110B) are energized; and

a circuit (figure 7A) for energizing the phase winding (110,111) over a plurality of energizing cycles to produce a given desired output on the rotor (column 11, lines 11-52), the energizing of the phase winding (110,111) cause movement of the at least two stator poles towards the rotor (figure 6A);

wherein the influence experienced by the at least two stator poles (created by windings 110,111 in figure 5A) over a first energizing cycle (θ_1-θ_2 in figure 6A) is different from the influence experienced by the at least two stator poles (created by windings 110,111 in figure 5A) over a subsequent energizing cycle (θ_1-θ_2 in figure 6A, and column 11, lines 11-52). Uzuka discloses that the rotor defines a plurality of rotor poles (107,108) and wherein:

during the first energization cycle, a first pair of opposing rotor poles (107) is brought towards alignment with the at least two stator poles (110);

over the second energization cycle, a second pair of opposing rotor poles (108) is brought towards alignment with the at least two stator poles (110); and

the construction of the poles forming the first pair of opposing rotor poles (107) is different from the construction of the poles forming the second pair of opposing rotor poles (108). Uzuka discloses that the angular width of the rotor poles forming the first pair of opposing rotor poles is substantially the same as the angular width of the rotor poles forming the second pair of opposing rotor poles (108A,108b,107a,107G in figure 18A). Uzuka discloses that the rotor includes a plurality of permanent magnets (108A,108b,107a,107G in figure 18A).

However, Uzuka does not disclose that the energizing of the phase winding also produces a normal force experienced by the at least two stator poles.

Keljik discloses that the energizing of the phase winding also produces a normal force (attracting or repulsing) experienced by the stator poles (which would cause the stator poles to move toward the rotor if it was not retained by the bearings page 9) since it is an inherent property of the magnetic fields.

It would have been obvious at the time the invention was made for the magnetic fields of Uzuka to apply a normal force between the fixed and movable poles of the machine since it is an inherent property of the magnetic fields.

Applicant respectfully traverses the conclusion that Uzuka in view of Keljik renders claims 6-8 and 13 obvious in so far as independent claim 6, as originally filed, contains limitations not disclosed or suggested in Uzuka in view of Keljik.

Argument has been posed that Uzuka discloses an electromagnetic machine having "a rotor (101) defining a plurality of rotor poles (108A, 108b 107a, 107G in figure 18A), each rotor pole having a pole face defining an angular width... wherein the influence experienced by the at least two stator poles (created by windings 110, 111 in figure 5A) over a first energization cycle (θ1–θ2 in figure 6A) is different from the influence experienced by the at least two stator poles (created by windings 110, 111 in figure 5A) over a subsequent energization cycle (θ1–θ2 in figure 6A and column 11, lines 11-52)."

Applicant respectfully disagrees with the argument posed above. The poles, windings, and energizations disclosed in Figures 5 and 6 of Uzuka do not correspond to the motor of Figure

18A and therefore cannot be used to represent poles, windings, and energizations of the motor in Figure 18A. The poles, windings, and energizations disclosed in Figures 5 and 6 of Uzuka correspond to the motor disclosed in Figures 3-4.

In the motor of Figure 3-4, the rotor has a north pole piece (107) and a south pole piece (108). "North pole piece 107 substends an angle 240° with respect to the motor axis, and south pole piece 108 substends and angle of 120°" (col. 7, ll. 27-30). In other words, the angular width of the north pole piece (107) in Figures 3-6 is twice that of the south pole piece (108). Consequently, the machine of Uzuka in Figures 3-6 does not meet limitations of claim 6, which requires that each rotor pole have "a pole face defining an angular width, wherein the angular width of the rotor pole with the widest width is: substantially equal to or greater than the angular width of the rotor pole with the narrowest width, and less than 1.5 times the angular width of the rotor pole with the narrowest width."

Moreover, with reference to the motor of Figures 3-6, Uzuka discloses that:

> the arcuate extent, or circumferential dimension, of one magnetic pole piece may be between 220° to 280°, while the angular extent, or circumferential dimension, of the other magnetic pole piece is in the range of 80° to 140°. As a still further limitation, the larger magnetic pole piece may exhibit a circumferential dimension of from 240° to 260°, while the smaller magnetic pole piece may exhibit a circumferential dimension of from 100° to 120°
> [col. 12, ll. 29-38]

Thus, Uzuka discloses that the angular widths of one pole piece with respect to another pole piece can be in a range of 1.57 to 3.5 or can be in a range of 2.0 to 2.6., which do not meet limitations of claim 6.

Consequently, Uzuka does not disclose or suggest all the limitations of claim 6. Keljik merely describes the phenomenon of attraction and repulsion of magnetic poles and fails to provide the limitations missing from Uzuka.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of Uzuka in view of Keljik cannot render Applicant's claim 6 obvious,

as these references, either alone or in combination, do not disclose or suggest all of Applicant's claim limitations.

For at least the reasons presented above, Applicant respectfully requests that the above rejection of independent claim 6 under 35 U.S.C. §103(a) be reconsidered and withdrawn and that the Examiner indicate the allowance of the claim in the next paper from the Office. The claims 7-8 and 13 depending from claim 6 are believed to be allowable for at least the same reasons discussed above.

4. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Uzuka in view of Keljik as applied to claim 8 above, and further in view of Horst et al. (U. S. Pat. 5,701,064).

Uzuka and Keljik substantially teaches the claimed invention except that it does not show that a maximum air gap established between the first pair of opposing rotor poles and the at least two stator poles is different from the maximum air gap established between the second pair of opposing rotor poles and the at least two stator poles.

Horst et al. disclose that a maximum air gap established between the first pair of opposing rotor poles (22b) and the at least two stator poles (18b in figures 1-2) is different from the maximum air gap established between the second pair of opposing rotor poles (22a) and the at least two stator poles (18b). The invention of Horst et al. has the purpose of detecting the rotor position.

It would have been obvious at the time the invention was made to modify the motor of Uzuka and Keljik and provide it with the air gap configuration disclosed by Horst et al. for the purpose of detecting the rotor position.

As noted above, Uzuka in view of Keljik does not disclose or suggest all of the limitations of claim 6 from which claims 8 and 9 depend. Horst '064 merely discloses that the air gap between rotor poles and stator poles is ideally uniform but in reality is not uniform and discloses that this non-uniformity can be used in detecting rotor position. See col. 5, ll. 10-30. Therefore, Horst '064 fails to provide the limitations missing from Uzuka in view of Keljik.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of Uzuka in view of Keljik and further in view of Horst et al. cannot render obvious Applicant's claim 9, as these references, either alone or in combination, do not disclose or suggest all of Applicants' claim limitations.

For at least the reasons presented above, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claim 9 under 35 U.S.C. § 103(a) and indicate

the allowance of the claim in the next paper from the Office. The claims depending from claim 9 are allowable for at least the same reasons discussed above.

5. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Uzuka in view of Keljik and further of Horst et al. as applied to claim 9 above, and further in view of Habermann (U. S. Pat. 4,774,424).

Uzuka, Keljik and Horst et al. substantially teaches the claimed invention except that it does not show that the maximum air gap established between the first pair of opposing rotor poles and the at least two stator poles is defined by a notch in the profile of the face of the rotor pole.

Habermann discloses that the maximum air gap established between the first pair of opposing rotor poles and the at least two stator poles is defined by a notch (31) in the profile of the face of the rotor pole. Habermann's invention has the purpose of effect a direct measuring of the induction in the air gap of an electromagnetic machine.

It would have been obvious at the time the invention was made to modify the machine disclosed by Uzuka, Keljik and Horst et al. and provide it with the notch disclosed by Habermann for the purpose of effect a direct measuring of the induction in the air gap of an electromagnetic machine.

As noted above, Uzuka in view of Keljik and further of Horst et al. does not disclose or suggest all the limitations of claim 6 from which claim 10 depends. Habberman merely discloses "a device for measuring the induction in the air gap of a magnetic bearing" (Abstract) and fails to provide the limitations missing from Uzuka in view of Keljik and further of Horst.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of Uzuka in view of Keljik and further of Horst et al. and further in view of Habermann cannot render Applicant's claim 10 obvious, as these references, either alone or in combination, do not disclose or suggest all of Applicants' claim limitations.

For at least the reasons presented above, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claim 10 under 35 U.S.C. § 103(a) and indicate the allowance of the claim in the next paper from the Office.

6. Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzuka in view of Keljik as applied to claim 6 above, and further in view of Delson et al. (U. S. Pat. 6,002,184).

Uzuka and Keljik substantially teaches the claimed invention except that it does not show that the circuit for energizing the phase winding provides an energization current to the phase winding over a first energization cycle that is different from the energization current provided to the phase winding over a second energization cycle.

Delson et al. disclose that the circuit for energizing the phase winding provides an energization current to the phase winding over a first energization cycle that is different from the energization current provided to the phase winding over a second energization cycle (column 36, lines 41-57). The invention of Delson et al. has the purpose of controlling the overall stiffness of the embodiment.

It would have been obvious at the time the invention was made to modify the motor of Uzuka and Keljik and provide it with the energization current pattern disclosed by Delson et al. for the purpose of controlling the overall stiffness of the embodiment.

As noted above, Uzuka in view of Keljik does not disclose or suggest all the limitations of claim 6 from which claims 11-12 depend. Delson et al. does not disclose using energization cycles and merely discloses selecting current levels for multiple actuators to achieve a desired mechanical stiffness between the actuators (col. 36, ll. 41-57). Therefore, Delson et al. fails to provide the limitations of claim 6 missing from Uzuka in view of Keljik and further fails to provide limitations required by claims 11-12.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of Uzuka in view of Keljik and further in view of Delson et al. cannot render Applicant's claims 11-12 obvious, as these references, either alone or in combination, do not disclose or suggest all of Applicants' claim limitations.

For at least the reasons presented above, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claims 11-12 under 35 U.S.C. § 103(a) and indicate the allowance of the claim in the next paper from the Office.

7. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over E. R. Lang (U. S. Pat. 3,260,871) in view of Keljik.

E. R. Lang discloses an electromagnetic machine comprising:

a rotor (24A) defining a plurality of rotor poles (N,S), each rotor pole (N,S) having a pole face defining an angular width, wherein the angular widths of each of the rotor poles (N,S) are substantially the same (figure 4);

a stator defining a first set of opposing stator poles (formed by coils 80) and a second set of opposing stator poles, each of the stator poles (formed by coils 80) being associated with at least one current carrying member (80) such that a stator pole is energized when current is flowing through a current carrying member associated with the stator pole (figures 8-9); and

a circuit (figure 8) for energizing the at least one current carrying member (80) over a given interval (figure 9) so as to simultaneously energize the first and second sets of opposing stator poles (figure 8);

the influence experienced by the first pair of opposing stator poles over the given interval is substantially different from the influence experienced by the second pair of opposing stator poles over the given interval. However, E. R. Lang does not disclose that energizing of the current carrying member also produces normal forces tending to cause movement of the energized stator poles towards the rotor.

Keljik discloses that the energizing of the phase winding also produces a normal force (attracting or repulsing) experienced by the stator poles (which would cause the stator poles to move toward the rotor if it was not retained by the bearings page 9) since it is an inherent property of the magnetic fields.

It would have been obvious at the time the invention was made for the magnetic fields of E. R. Lang to apply a normal force between the fixed and movable poles of the machine since it is an inherent property of the magnetic fields.

Applicant respectfully traverses the conclusion that Lang in view of Keljik renders claim 14 obvious in so far as claim 14, as originally filed, contains limitations not disclosed or suggested in Lang in view of Keljik.

Argument has been posed that Lang discloses an electromagnetic machine having "a rotor (24A) defining a plurality of rotor poles (N, S), each rotor pole (N,S) having a pole face defining an angular width, wherein the angular widths of each of the rotor poles (N,S) are substantially the same (figure 4)" and having "a stator defining a first set of opposing stator poles (formed by coils 80) and a second set of opposing stator poles, each of the stator poles (formed by coils 80) being associated with at least one current carrying member (80) such that a stator pole is energized when current is flowing through a current carrying member associated with the stator pole (figures 8-9)."

Applicant respectfully disagrees with the argument posed above. The rotor (eccentric magnet 24A) of Figure 4 is used with the coils (20) and the circuit of Figures 1 and 3. The coils (20) do not define first and second sets of opposed stator poles as required by claim 14. In addition, the coils (20) are disclosed as being energized singly by the circuit of Figures 1 and 3 (see Lang at col. 3, ll. 36-52). Consequently, the coils (20) and the circuit of Figures 1 and 3 do not meet further requirements of claim 14 of "a circuit for energizing the at least one current carrying member over a given interval so as to simultaneously energize the first and second sets of opposing stator poles."

Furthermore, the rotor (eccentric magnet 24A) of Figure 4 is not disclosed as being combined with the opposed coils (60) of Figure 5 nor the circuit, the coils (80), and the current disclosed in Figures 8-9. In fact, Lang teaches away from combining the rotor (eccentric magnet 24A) of Figure 4 with opposing stator coils. See Lang at col. 4, ll. 54-65.

Moreover, the machines disclosed in Figures 5-9 of Lang also do not suggest or disclose the limitations of claim 14. For example, the coils (60) of Figure 5 are individually energized (see Lang at col. 4, line 49 to col. 5, line 4), which does not meet limitations of claim 14. For

example, the rotors 70, 74, and 78 in Figures 6-7 of Lang are disclosed as eccentric, bent magnets, which do not meet limitations of claim 14.

Consequently, Lang does not disclose or suggest all of the limitations of claim 14. Keljik merely describes the phenomenon of attraction and repulsion of magnetic poles and fails to provide the limitations of claim 14 missing from Lang. Accordingly, Applicant submits that Lang in view of Keljik does not render claim 14 obvious.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of Lang in view of Keljik cannot render Applicant's claim 14 obvious, as these references, either alone or in combination, do not disclose or suggest all of Applicant's claim limitations.

For at least the reasons presented above, Applicant respectfully requests that the above rejection of independent claim 14 under 35 U.S.C. §103(a) be reconsidered and withdrawn and that the Examiner indicate the allowance of the claim in the next paper from the Office. The claims depending from claim 14 are believed to be allowable for at least the same reasons discussed above.

8. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over E. R. Lang in view of Keljik as applied to claim 14 above, and further in view of Uzuka.

E. R. Lang and Keljik substantially teaches the claimed invention except that it does not show that during the given interval, a second pair of opposing rotor poles is brought towards alignment with second set of opposing stator poles; and that

the construction of the poles forming the first pair of opposing rotor poles is different from the construction of the poles forming the second pair of opposing rotor poles.

Uzuka discloses that during the given interval, a second pair of opposing rotor poles (107) is brought towards alignment with second set of opposing stator poles (110); and that

the construction of the poles forming the first pair of opposing rotor poles (108) is different from the construction of the poles forming the second pair of opposing rotor poles (108). Uzuka's invention has the purpose of avoiding the reduction of the operational torque generated over 360 degrees to zero torque.

It would have been obvious at the time the invention was made to modify the motor of E. R. Lang and Keljik and provide it with the rotor poles configuration disclosed by Uzuka for the purpose of avoiding the reduction of the operational torque generated over 360 degrees to zero torque.

As noted above, independent claim 14 from which claim 18 depends contains limitations not disclosed or suggested by Lang in view of Keljik. Uzuka fails to provide the limitations missing from Lang in view of Keljik.

Moreover, claim 14 from which claim 18 depends requires that the each rotor pole have "a pole face defining an angular width, wherein the angular widths of each of the rotor poles are substantially the same." As noted above, Uzuka discloses that the angular widths of the first and second pairs of opposing rotor poles (107 and 108) are different and therefore does not disclose or suggest other limitations required by claims 14 and 18.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of Lang in view of Keljik and further in view of Uzuka cannot render Applicant's claim 18 obvious, as these references, either alone or in combination, do not disclose or suggest all of Applicant's claim limitations.

For at least the reasons presented above, Applicant respectfully requests that the above rejection of claim 18 under 35 U.S.C. §103(a) be reconsidered and withdrawn and that the Examiner indicate the allowance of the claim in the next paper from the Office.

9. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over E. R. Lang in view of Keljik as applied to claim 14 above, and further in view of Nitta (U. S. Pat. 6,181,047).

E. R. Lang and Keljik substantially teaches the claimed invention except that it does not show that the construction of the stator poles comprising the first set of opposing stator poles is different from the construction of the stator poles comprising the second set of opposing stator poles.

Nitta discloses that the construction of the stator poles comprising the first set of opposing stator poles (5) is different from the construction of the stator poles comprising the second set of opposing stator poles (4) for the purpose of improving starting characteristics in permanent magnet motors.

It would have been obvious at the time the invention was made to modify the motor of E. R. Lang and Keljik and provide it with the stator poles configuration disclosed by Nitta for the purpose of improving starting characteristics in permanent magnet motors.

As noted above, Lang in view of Keljik does not disclose or suggest all of the claim limitations of claim 14 from which claim 15 depends. Nitta merely discloses reducing the net cogging torque in a permanent magnet motor by using graded air gaps and fails to provide the limitations missing from Lang in view of Keljik required by claim 14.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of Lang in view of Keljik and further in view of Nitta cannot render Applicant's claim 15 obvious, as these references, either alone or in combination, do not disclose or suggest all of Applicant's claim limitations.

For at least the reasons presented above, Applicant respectfully requests that the above rejection of claim 15 under 35 U.S.C. §103(a) be reconsidered and withdrawn and that the Examiner indicate the allowance of the claim in the next paper from the Office.

10. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over E. R. Lang in view of Keljik and further of Nitta as applied to claim 15 above, and further in view of Horst (U. S. Pat. 5,670,836).

E. R. Lang, Keljik and Nitta substantially teaches the claimed invention except that it does not show that each of the stator poles in the first set of opposing stator poles defines a notched surface.

Horst discloses that each of the stator poles in the first set of opposing stator poles defines a notched surface (C). Horst's invention has the purpose of positioning the rotor in a stable detent position to facilitate starting of the machine.

It would have been obvious at the time the invention was made to modify the machine of E. R. Lang, Keljik and Nitta and provide it with the notch configuration disclosed by Horst for the purpose of positioning the rotor in a stable detent position to, facilitate starting of the machine.

As noted above, by Lang in view of Keljik does not disclose or suggest all of the limitations of claim 14 from which claim 16-17 depend. Horst '836 merely discloses using homopolar stator poles with indentations (36) to align in a stable detent position with homopolar rotor poles when the machine is stopped, *i.e.*, when the stator poles are not energized (see col. 4, lines 8-32). Because aligning of the rotor with the stator is performed when the stator poles are not energized, Horst '836 is silent as to the stator windings, energizations, normal forces, and circuit for energizing the windings. Therefore, Horst '836 does not provide the limitations required by claim 14 that are missing from Lang in view of Keljik and further of Nitta.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of Lang in view of Keljik and further of Nitta, and further of Horst '836 cannot render Applicant's claims 16-17 obvious, as these references, either alone or in combination, do not disclose or suggest all of Applicant's claim limitations.

For at least the reasons presented above, Applicant respectfully requests that the above rejection of claims 16-17 under 35 U.S.C. §103(a) be reconsidered and withdrawn and that the Examiner indicate the allowance of the claim in the next paper from the Office.

11. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over E.R. Lang in view of Keljik as applied to claim 14 above, and further in view of Delson et al.

E. R. Lang and Keljik substantially teaches the claimed invention except that it does not show that the circuit for energizing the at least one current carrying member provides an energization current to the first current carrying member that is different from the energization current provided to the second current carrying member over the given interval.

Delson et al. disclose that the circuit for energizing the at least one current carrying member provides an energization current to the first current carrying member that is different from the energization current provided to the second current carrying member over the given interval (column 36, lines 41-57). The invention of Delson et al. has the purpose of controlling the overall stiffness of the embodiment.

It would have been obvious at the time the invention was made to modify the motor of E. R. Lang and Keljik and provide it with the energization current pattern disclosed by Delson et al. for the purpose of controlling the overall stiffness of the embodiment.

As noted above, Lang in view of Keljik does not disclose or suggest all of the limitations of claim 14 from which claims 19 depends. Delson et al. merely discloses adjusting the current levels to change the mechanical stiffness of a system. See col. 36, ll. 41-57. Therefore, Delson et al. fails to provide the limitations missing from Lang in view of Keljik.

Even if it were appropriate to combine these references, which Applicant does not concede, the combination of Lang in view of Keljik and further in view of Delson et al. cannot render Applicant's claim 19 obvious, as these references, either alone or in combination, do not disclose or suggest all of Applicants' claim limitations.

For at least the reasons presented above, Applicant respectfully requests that the above rejection of claims 19 under 35 U.S.C. §103(a) be reconsidered and withdrawn and that the Examiner indicate the allowance of the claim in the next paper from the Office.

Response to Arguments

Applicant's arguments with respect to claims 1-19 have been considered but are moot in view of the new ground(s) of rejection.

Applicant has presented new arguments in response to the new grounds of rejection.

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In order to facilitate the resolution of any issues or questions presented by this paper, Applicant respectfully requests that the Examiner directly contact the undersigned by phone to further the discussion, reconsideration, and allowance of the claims.

Respectfully submitted,

Date: November 27, 2002

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ATTACHMENT

MARKED-UP VERSION OF THE CLAIMS AS AMENDED BY THIS RESPONSE

1. (Twice Amended) A linear electromagnetic machine comprising:

a movable member;

a stationary member defining at least one stationary pole;

a phase winding positioned such that, when current is flowing in the phase winding, the at least one stationary pole is energized; and

a circuit for energizing the phase winding over a plurality of energization cycles with a unidirectional current of a single polarity, ~~to produce~~ the energizing of the phase winding producing a given force tending to cause linear movement of the movable member with respect to the stationary member, the energizing of the phase winding also producing a normal force tending to cause movement of the movable and stationary members in a direction normal to the desired linear movement;

wherein the normal force profile experienced by the at least one stationary pole over a first energization cycle is different from the normal force profile experienced by the at least one stationary pole over a subsequent energization cycle.

7. (Once Amended) The electromagnetic machine of claim 6, wherein the rotor defines a plurality of pairs of opposing rotor poles and wherein:

a) during the first energization cycle, a first pair of opposing rotor poles is brought towards alignment with the at least two stator poles;

b) over the second energization cycle, a second pair of opposing rotor poles is brought towards alignment with the at least two stator poles; and

c) the construction of the poles forming the first pair of opposing rotor poles is different from the construction of the poles forming the second pair of opposing rotor poles.

18. (Once Amended) The electromagnetic machine of claim 14, wherein the construction of the stator poles comprising the first set of opposing stator poles is substantially the same as the construction of the stator poles comprising the second set of opposing stator poles and wherein:

a) during the given interval, a first pair of opposing rotor poles is brought towards alignment with the first set of opposing stator poles;

b) during the given interval, a second pair of opposing rotor poles is brought towards alignment with the second set of opposing stator poles; and

c) the construction of the poles forming the first pair of opposing rotor poles is different from the construction of the poles forming the second pair of opposing rotor poles.